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A survey of *Nosema apis* infection in apiaries of North Khorasan province, Iran

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Abstract

Nosema apis is an obligate intracellular parasite belonging to phylum Microsporidia. This para site is known as main causative agent of nosemosis in honeybees especially in the European honeybee (*Apis mellifera*). Nosemosis can cause queen supersedure, reduction of honey yield and dwindling the population of honeybees. A total number of 54 apiaries were randomly sampled from April to July 2011 and April to July 2012 in North Khorasan province, Iran. Collected samples were examined for infection to *N.apis*. In the collected bees from 30 apiaries, any Nosema infection was not observed in spring 2011, while of 24 apiaries sampled in spring 2012, 12 (50%) apiaries were infected with *N. apis*. The seasonal rainfall of spring in 2012 in the study area was 53% higher than the same period of last year. It was concluded that there has been a direct relationship between rainfall and frequency of N. *apis* infection in apiaries of North Khorasan province.

Keywords: Frequency, *Nosema apis*, Apiary, North Khorasan Province

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Introduction

Nosema apis is an obligate intracellular parasite belonging to phylum Microsporidia. This parasite is known as main causative agent of nosemosis in honeybees especially in the European honeybee (*Apis mellifera*) (Zander, 1909). In recent years, there have been some reports about natural infection of *A. mellifera* with *Nosema ceranae* across the world (Klee *et al*., 2007). Nosemosis can cause queen supersedure to reduce the honey yield and dwindle the population of honeybees (FAO, 2006).

Nosemosis has been an endemic disease in Iran (Lotfi *et al*., 2009) and this disease is attributed to *N. apis*. Limited studies have been conducted on prevalence and seasonal activity of *Nosema* in Iran. All of these studies have been conducted in the North West of Iran and results of them have shown that the frequency of *Noseam* infection was higher in the spring than other seasons (Lotfi *et al*., 2009; Razmaraii and Karimi, 2010).

According to Iranian veterinary organization reports (2008) there are 37780 honeybee colonies in the North khorasan Province, Iran. The aim of this study was to assess the frequency of *Nosema apis* infection in the apiaries of this province of Iran.

Materials and methods

study area

North Khorasan Province is located in the North East of Iran between 36°37′-38°17′ N latitudes and 55°53′-58°20′ E longitudes with an area more than 28,400 km^2. It has common border in the North with Turkmenistan (Fig.1). This region is a mountainous area and has average annual rainfall about 250 mm.

Sampling and parasitological examinations

A total of 54 apiaries were randomly sampled from April to July 2011 and April to July 2012. From these 54 apiaries, 30 apiaries were sampled in spring 2011 and the rest of them in spring 2012. Five colonies were selected in each apiary and 50 adult honeybees were collected from each colony. The specimens in the containers like saltshaker were transferred to parasitology laboratory. After freezing for two hours and death of specimens, the abdomens of honeybees were separated from their bodies. These abdomens were macerated in 10 ml distilled water and were crushed in a mortar. Then, suspension was passed through a 100 µm mesh sieve for removing the debris and was centrifuged for 6 min at 800 g. Finally, the supernatant was discarded and the pellet was examined under the common light microscope at 400x magnification. This methodology was used for determination of the presence of *Nosema* spores in all of the collected samples (OIE, 2008).

Collection of meteorological data

In July 2012, the average seasonal rainfall of spring 2011 and spring 2012 in each city of the study area was taken from Meteorological Office of North Khorasan province.

Results

In this survey, 30 apiaries in 2011 and 24 apiaries in 2012 were examined for detection of *N. apis* infection. Only 12 apiaries sampled in 2012 were infected with *N. apis* (Fig. 2). The data of seasonal rainfall in two years showed an increase in the average rainfall in spring 2012 comparing to spring 2011 in the study area (Fig. 3). The data analysis indicated a direct relationship between rainfall and frequency of *Nosema* infection.

Discussion

Regarding the importance of honeybees in production of honey and royal jelly and also the role of these insects in pollination, their protection against pathogenic agents such as *Nosema* is necessary. In the present study, *N. apis* infection was only detected in 50% (12/24) of sampled apiaries in spring 2012. Other studies showed the frequency of *N. apis* infection from 46.5% to 81% in the North West of Iran (Razmaraii and Karimi, 2010;



Figure 1. **The map of Iran and location of the study area.**

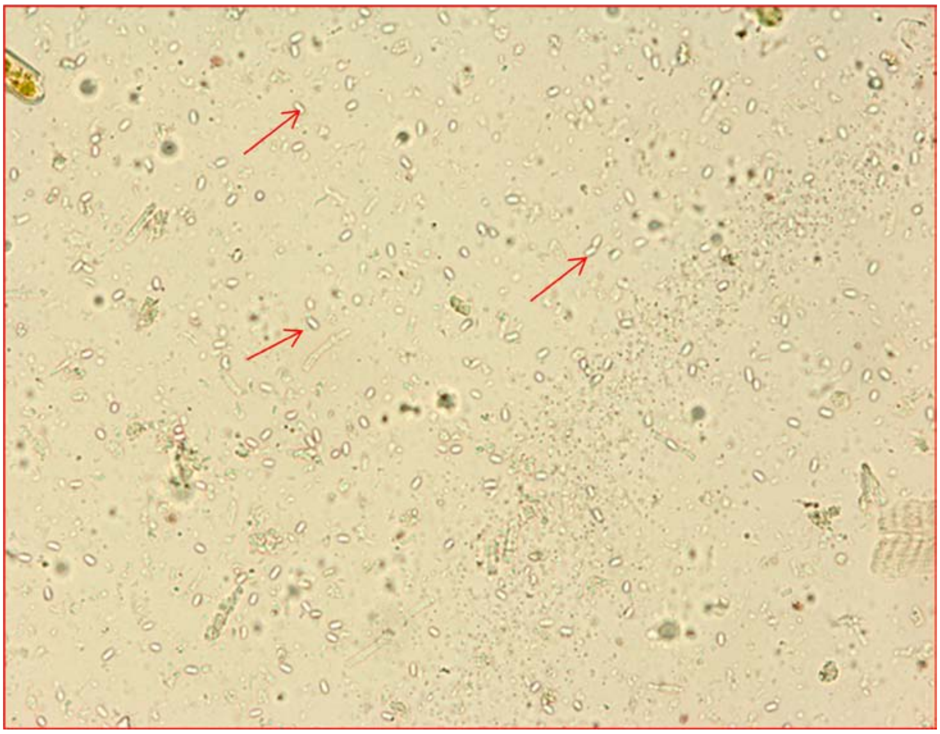
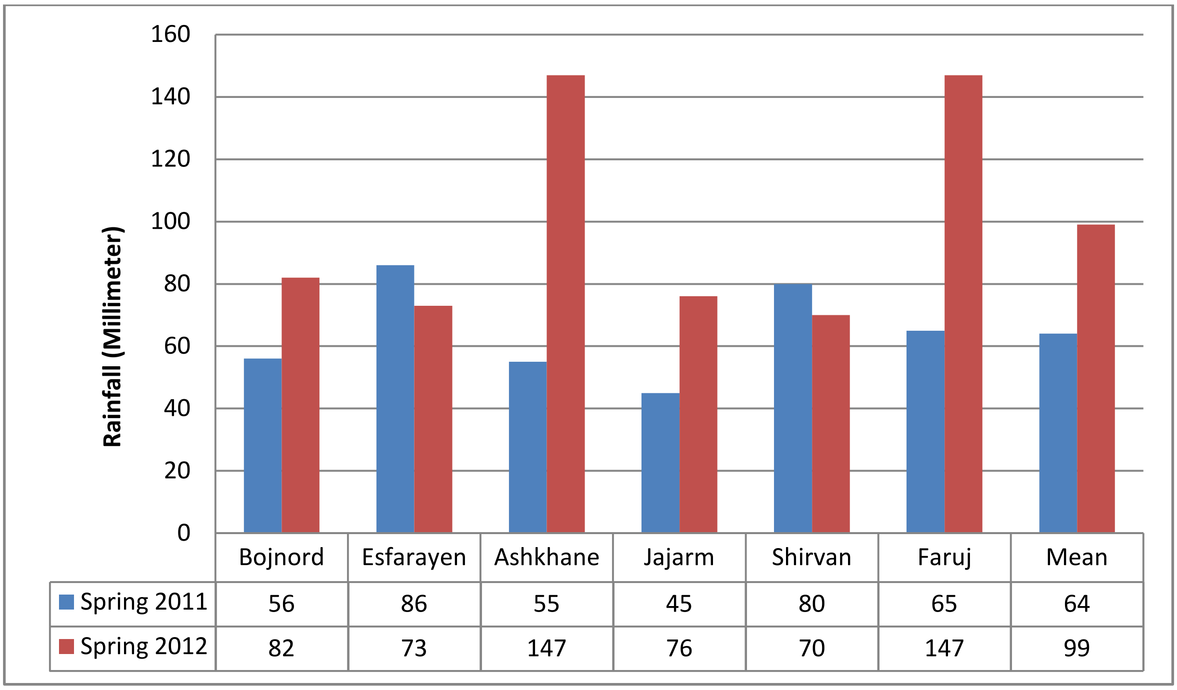


Figure 2. **Spores of *N. apis* (red arrows) at 400x magnificatin.**



	Bojnord	Esfarayen	Ashkhane	Jajarm	Shirvan	Faruj	Mean
Spring 2011	56	86	55	45	80	65	64
Spring 2012	82	73	147	76	70	147	99

Figure 3. Comparison between the mean rainfalls in each city in two sampling periods in the study area.

Davoudi *et al*., 2009). These differences can be attributed to lower humidity and less rainfall in the study area compared to the mentioned areas.

In the present study, an increase in the average rainfall occurred in spring 2012 in comparison with similar season in 2011 and presumably due to this, high frequency of *N. apis* infection was observed in sampled apiaries in spring 2012.

Lotfi *et al*. (2009) showed the highest frequency of *N. apis* infection in the spring (59.5%) and low frequency in the in the summer and autumn. Razmaraii and Karimi (2010) also reported that the frequency of *N. apis* infection was high (46.5%) in the spring and was low (1.3%) during the summer in East Azerbaijan Province. They concluded that high level of humidity in the spring was the cause of these findings.

According to Aydin *et al*. 2005 precipitation is a significant factor for predicting nosemosis in wet regions. They emphasized that high precipitation regions act as reservoirs for *N. apis*.

Increase in rainy and cloudy days has been reported as the main cause of high infection rate to *N. apis* in spring 2003 in Urmia region (Tavassoli *et al*., 2009). Based on their opinion, rainy and cloudy weather causes the honeybees to stay more often in hives and subsequently spore excretion and its intake increases.

It is noteworthy, that nosemosis are created by *N. apis* in special conditions. Cold winter, high rainfall, poor management of the apiary especially in winter, other parasitic diseases and agriculture pesticide are risk factors that increase susceptibility of honeybees to *N. apis* (Razmaraii and Karimi, 2010).

In conclusion, the results of this study revealed that nosemosis is a potential threat for the beekeeping industry in this region. Therefore, it is recommended that combination of Fumagillin treatment and sterilization of apicultural equipments be used for control of nosemosis.

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بررسی آلودگی به نوزما آپیس در زنبورستان‌های استان خراسان شمالی، ایران

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چکیده

نوزما آپیس یک انگل داخل سلولی اجباری متعلق به شاخه میکروسپوریدا است. این انگل عامل اصلی ایجاد نوزموزیس در زنبورعسل بویژه زنبور عسل اروپایی می باشد. نوزموزیس باعث تعویض ملکه، کاهش تولید عسل و کاهش جمعیت یک کلونی می گردد. در مطالعه حاضر تعداد ۵۴ زنبورستان به صورت تصادفی در دو بازه زمانی فروردین تا تیرماه سال ۱۳۹۰ و فروردین تا تیرماه سال ۱۳۹۱ در استان خراسان شمالی نمونه برداری شدند. برای تعیین آلودگی به نوزما آپیس، نمونه های گرفته شده در آزمایشگاه مورد بررسی قرار گرفتند. در نمونه های گرفته شده از ۳۰ زنبورستان در بهار سال ۱۳۹۰ آلودگی به نوزما دیده نشد در حالیکه در ۱۲ زنبورستان از ۲۴ زنبورستان نمونه گیری شده در بهار سال ۱۳۹۱ آلودگی به نوزما آپیس مشاهده شد. مقایسه میزان بارندگی در دو دوره زمانی نمونه گیری نشان داد میزان بارندگی در منطقه مورد مطالعه، در بهار ۱۳۹۱ در مقایسه با مدت مشابه سال قبل ۵۳٪ افزایش داشته است. نتایج این مطالعه ارتباط مستقیم میزان بارندگی با میزان فراوانی آلودگی به نوزما را نشان داد .

واژگان کلیدی: فراوانی، بارندگی، نوزما آپیس، زنبورستان، استان خراسان شمالی